NON-PUBLIC?: N
ACCESSION #: 8711190085
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Nine Mile Point Unit 1 PAGE: 1 of 6

DOCKET NUMBER: 05000220

TITLE: Electrical Pressure Regulator Servo-Valve Malfunction Results In Reactor Scram, High Pressure Coolant Injection Mode Of Feedwater And Main Steam Isolation Valve Closure
EVENT DATE: 10/16/87 LER #: 87-014-00 REPORT DATE: 11/16/87

OPERATING MODE: N POWER LEVEL: 89

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(i), 50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Mr. Peter Mazzaferro, Assistant Supervisor, Technical Support
TELEPHONE #: 315-349-2190

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: TG COMPONENT: 90 MANUFACTURER: M423
REPORTABLE TO NPRDS: N
CAUSE: X SYSTEM: SB COMPONENT: PR MANUFACTURER: G080
REPORTABLE TO NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: During normal operation on October 16, 1987, a malfunction of the turbine control system caused steam pressure oscillations, resulting in a reactor scram from a power excursion to the Average Power Range Monitor high neutron flux scram setpoint.
The High Pressure Coolant Injection mode of feedwater initiated due to the momentary low reactor water level, which was the result of the reactor scram. The turbine control system malfunction also caused reactor pressure to decrease such that closure of the Main Steam Isolation Valves occurred as a protective action. The turbine control system failure has been attributed to a stuck servo-valve in the Electrical Pressure Regulator hydraulic actuator. An immediate corrective action included replacement of the servo-valve. Increased preventive maintenance of the Electrical Pressure Regulator will also be scheduled. Alternative designs will be evaluated.

A violation of Technical Specifications resulted due to personnel error regarding the tardiness of the 10 CFR 50.72 four hour notification for the Main Steam Isolation Valve closure. Additional training regarding the reportability of occurrences will be developed.

(End of Abstract)

I. DESCRIPTION OF EVENT

At 0026 hours on October 16, 1987, while operating at 88.5% power (540 MWe), Nine Mile Point Unit 1 (NMP1) experienced a reactor scram due to a reactor power excursion to the Average Power Range Monitor (APRM) high neutron flux reactor scram setpoint. The power excursion was the result of collapsed voids and subsequent increased reactivity due to a pressure spike during pressure oscillations. The pressure oscillations occurred from modulation of the Turbine Control Valves (TCV's) due to a malfunction of the turbine control system. The pressure oscillations were unable to be controlled either manually or automatically. High Pressure Coolant Injection (HPCI) mode of feedwater initiated as voids collapsed from the scram, dropping reactor water momentarily past the low level HPCI mode of feedwater initiation setpoint. Main Steam Isolation Valve (MSIV) closure resulted from a rapid reactor pressure decrease during a down swing of the pressure oscillations.

The reactor scram occurred less than three minutes after weekly turbine valve testing had commenced per Preventive Maintenance Procedure N1-PM-W4, "Weekly Turbine Valve Log". Upon stroking the first Turbine Stop Valve (TSV), pressure oscillations began, undetected initially but increasing in amplitude. Approximately thirty seconds after testing had begun, rod blocks started alarming and clearing from APRM upscale trips due to the pressure oscillations. The Chief Shift Operator (CSO) immediately began investigating the cause of the rod block alarms. Reactor pressure was initially observed to be constant of a stuck pen on the suppressed range (950-1050 psig) reactor pressure chart recorder. This caused a slight delay in identification that there were pressure oscillations, and thus appropriate corrective actions. When the CSO realized that the Electrical Pressure Regulator (EPR) was causing TCV modulation, an attempt was made to bring the Mechanical Pressure Regulator (MPR) into control. The MPR is maintained in a stand-by mode as a backup to the EPR. This was unsuccessful, and the Reactor scrammed on high neutron flux, generated as a result of an increasing pressure spike during the oscillations.

After the scram, the EPR malfunction continued, causing abnormal

operation of the Turbine Bypass Valves (TBV's), resulting in the occurrence of a reactor low pressure condition (less than 850 psig) at approximately twenty seconds after the scram. The low pressure signal coincident with the mode switch in the "RUN" position, caused MSIV closure, as designed. The lowest reactor pressure attained was approximately 650 psig. However, the maximum cooldown rate was not exceeded. The mode switch was placed in the "REFUEL" position approximately forty-five seconds after the scram. After reactor pressure stabilized, the MSIV's were reopened to utilize the main condenser as a heat sink. Cooldown rate was maintained by manual control of the TBV's via the Bypass Valve Opening Jack, vice automatic control with the MPR, since it was not known at the time if the MPR was functioning properly. The remainder of the scram recovery was normal, and an orderly shutdown and cooldown was completed.

I. DESCRIPTION OF EVENT (Cont'd)

The 10 CFR 50.72 notifications for the reactor scram and HPCI mode of feedwater initiation were made at 0115 hours. However, the MSIV closure notification was inadvertently ommitted at that time. The NRC was not notified of this event until 1100 hours. This is not in accordance with the four hour reporting requirements of 10 CFR 50.72, and is a violation of Technical Specification Section 6.6, "Reportable Event Action".

II. CAUSE OF THE EVENT

The root cause of the event was failure of the EPR servo-valve due to binding of its internal components. This was the result of the presence of impurities in the turbine control oil.

After the event, the turbine control unit, which consists of the EPR, MPR, Bypass Valve Opening Jack and associated linkage, was inspected. Everything checked out satisfactorily except the servo-valve on the EPR's hydraulic actuator, which appeared to be stuck. The servo-valve was removed for inspection. A large amount of particles were found in its internal filter assembly. There was also evidence that minute particles had passed through the filter and restricted the movement of the internal pilot spool, which regulates control oil flow to the hydraulic actuator that positions the control linkage. Restricted movement of the pilot spool will act to slow the response time of the EPR, as will plugging of the internal filters. If the pilot spool becomes sticky or slow in moving, the hydraulic actuator's piston will tend to move in the direction last ported by the pilot spool for a longer period of time than desired, thus over

compensating on each pressure swing. The turbine oil system is utilized for turbine lubrication and seals, as well as hydraulic turbine control. Therefore, the oil system has the potential for becoming dirty, and, without adequate filtration, may cause problems since the EPR servo-valve requires high purity oil. Flow restriction due to plugged filters may have been a contributing factor to the servo-valve failure. This, however, can not be confirmed.

If the EPR failed in an increasing pressure direction, the MPR would have assumed control because its setpoint is approximately 10 to 15 psig above the EPR's. However, the pressure oscillated about the MPR setpoint and when the pressure decreased past it on a down swing, the EPR resumed control. This occurred even though the MPR setpoint was being reduced in an attempt to bring it into control during the pressure oscillations.

Evidence suggests that the TBV's spuriously remained open for approximately two minutes after the scram. This indicates that after the scram, the EPR control linkage was slow to move to a position commensurate with the EPR setpoint pressure, and was in a position that called for a substantial pressure reduction.

II. CAUSE OF THE EVENT (Cont'd)

The time lag in verifying the pressure oscillations due to the malfunctioning chart recorder may have been a contributing factor of the scram. It caused the delay of operator actions to attempt to correct the problem with the turbine control system. It is doubtful, however, if the problem could have been corrected, even with the several additional seconds in which to act.

The failure to notify the NRC of the MSIV initiation per 10 CFR 50.72 is due to personnel error on the part of the NMPC Assistant Station Shift Supervisor on duty at the time. There was confusion regarding the reportability of the event. A review of the event was performed by the NMPC operations personnel following the shift change and the notification was made at that time.

III. ANALYSIS OF THE EVENT

Although the MPR was available as a back-up to the EPR, the EPR failed in such a way that it prevented the MPR from gaining control of the pressure control unit. However, all safety aspects of the event have been previously analyzed and are included in the Nine Mile Point Unit 1

Final Safety Analysis Report (FSAR). The ESF actuations (reactor scram, HPCI mode of feedwater initiation, and MSIV closure) occurred automatically, as designed, per their critical Reactor Protection System (RPS) parameters, such that no adverse safety consequences or severe transients resulted. At no time during or after the event was the reactor in an unsafe condition.

Review of the suppressed range reactor pressure and TCV and TBV position strip charts from the previous week's turbine valve testing revealed normal operation of the turbine control system. There was no apparent widening of the reactor pressure chart recorder trace during that week, which might indicate a slowing of the EPR response due to a sticky servo-valve pilot spool or plugging of the filters. There was no way of knowing of an impending failure of the servo-valve.

IV. CORRECTIVE ACTIONS

The investigation of the EPR failure after the scram revealed that the EPR servo-valve had malfunctioned. Immediate corrective actions involved replacing the servo-valve and verifying proper movement of the control linkage of the EPR, as well as the MPR and related mechanical components, to ensure that the turbine control unit was mechanically sound. Additional corrective actions will involve increased preventative maintenance on the EPR. Currently, the servo-valve is replaced during refueling outages and checked when problems develop. A procedure will be developed to replace the servo-valve annually, and replace its internal filter at six month intervals. A Problem Report has been initiated to request an evaluation to determine appropriate long term corrective actions regarding the reliability of the EPR. As a minimum, the following proposals will be evaluated:

1. The addition of more adequate and more accessible filtration;

2. The addition of a separate closed loop hydraulic system utilizing high purity oil for the EPR and related components; and

3. The replacement of the existing servo-valve with a model that is less susceptible to sticking (larger clearances between internal components).

Performance of any or all of the above corrective actions will tend to decrease the probability of recurrence of a similar event.

A work request was written to repair the reactor vessel suppressed range pressure chart recorder, as an immediate corrective action. This was done and the device was returned to service. A Problem Report (PR-201) was written by the Assistant Station Shift Supervisor, on duty during the event, which stated that the stuck pens are difficult to identify during steady state operation, and requested a resolution regarding the malfunctioning chart recorders. New mechanisms have been ordered from the vendor. Replacement of the devices with more reliable, state of the art units is under evaluation.

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g corrective actions for the personnel error that led to the tardiness of the 10 CFR 50.72 notification, a Training Modification Recommendation will be issued to request that reporting requirements are more adequately addressed during Licensed Operator Requalification Training.

V. ADDITIONAL INFORMATION

LER 85-05 was written in response to a turbine control system malfunction which occurred in April 1985. This event occurred due to an apparent electronics problem and not a problem associated with the EPR servo-valve. There have been instances in the past where EPR problems have developed due to plugging of the servo-valve filters.

V. ADDITIONAL INFORMATION (Cont'd)

SYSTEMS REFERRED TO IN THIS LER

IEEE 803 IEEE 805
System EIIS Function System ID

APRM MON IL

Turbine Control System RG JJ

Main Steam System ISV SB
PI SB

Feedwater LC SJ

Turbine Oil System 90 TG

COMPONENT FAILURES

IEEE 803 IEEE 805
Component Manuf. Code Model No. EIIS Function System ID

Chart Recorder G080 531 PR SB

Servo-Valve M423 73-406 90 TG

ATTACHMENT # 1 TO ANO # 8711190085 PAGE: 1 of 1

NIAGARA MOHAWK POWER CORPORATION

NIAGARA MOHAWK

301 PLAINFIELD ROAD
SYRACUSE, NY 13212

THOMAS E. LEMPGES
VICE PRESIDENT -- NUCLEAR GENERATION NMP29725

November 16, 1987

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

RE: Docket No. 50-220
LER 87-14

Gentlemen:

In accordance with 10 CFR 50.73, we hereby submit the following Licensee Event Report:

LER 87-14 Which is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv), "Any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS). However, actuation of an ESF, including the RPS, that resulted from and was part of the preplanned sequence during testing or reactor operation need not be reported;" and

10 CFR 50.73 (a)(2)(i)(B), "Any operation or condition prohibited by the plant's Technical Specifications;"

Telephone notifications per 10 CFR 50.72 were made at 0115 and 1100,

respectively, on October 16, 1987.

This Licensee Event Report was completed in the format designated in NUREG-1022, Supplement 2, dated September 1985.

Very truly yours,

/s/ Thomas E. Lempges
Thomas E. Lempges
Vice President
Nuclear Generation

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Attachment

cc: William T. Russell
Regional Administrator

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